Department of Chemistry and Geosciences

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Students who complete the major in chemistry will graduate with a Bachelor of Science degree. The program in chemistry is approved by the Committee on Professional Training of the American Chemical Society. Students who complete the approved major will have their degree certified by the American Chemical Society.

All chemistry majors complete the general chemistry sequence and a common forty-hour sequence of major courses. These courses, plus the prerequisite hours in physics and mathematics, provide each student with a solid background in analytical, inorganic, organic, physical, and biochemistry.

Each student is required to select 6 hours of advanced chemistry courses as part of the major. The selection, made with the assistance of a departmental advisor, will be made with the postgraduate needs of the student in mind. Students who wish to pursue graduate study in chemistry should select all chemistry courses, while those who wish to accept positions in industrial or government laboratories may wish to select some chemistry and some biology courses to complete the major. Those who plan to attend professional school (medicine, dentistry, veterinary medicine, law, or business) will select courses to satisfy entry requirements in the particular program of interest.

The chemistry major is designed for students to develop the critical thinking skills needed for problem solving. Students will be able to state a problem succinctly, outline methods of solving the problem, and proceed to solve the problem after choosing a suitable method. Mastery of problem solving techniques is especially apparent in students who participate in an undergraduate research project. Although the research problems chosen for solution by students are taken from the chemical sciences, the methods developed for problem solving are applicable to other fields.

The core curriculum provides opportunity for every student in the University to obtain the skills necessary for effective written and oral communication. The department requires chemistry majors to demonstrate mastery of those skills by preparing and presenting papers in advanced chemistry courses. Each senior must present a departmental seminar on a topic which is generally not covered in courses in the department. Successful completion of the departmental seminar will demonstrate that the student is able to search the literature on an unfamiliar topic, prepare a pertinent outline and abstract of the topic, present the material in a clear oral presentation, and answer questions on the topic from both faculty and student colleagues. Majors may satisfy the requirement for the senior seminar by completing CHEM 4210.

Selected Educational Outcomes

The major in chemistry is designed to prepare graduates to enter professional school, to attend graduate school, or to join the work force in a government, industrial, or commercial setting. Among the anticipated educational outcomes of the department are that each graduate will:

1. understand, speak, and write in the language used by professional chemists;
2. demonstrate proficiency in the principles and theories of chemistry; in problem solving and experimental design; in laboratory procedures and the skills of measurement, analysis, and data treatment and interpretation.
3. demonstrate an understanding of professional ethics in data collection, evaluation, and reporting; and understanding of environmental issues including handling and disposal of chemicals and chemical wastes; and understanding of the importance of chemistry and its impact on society.

Examples of Outcome Assessments

In order to follow the success with which the educational outcomes are fulfilled, the chemistry department has developed a number of assessment techniques, both formal and informal. The formal assessment techniques include the following:

1. Each student will complete standardized, discipline-related American Chemical Society examinations.
2. Each student will complete assignments in multiple classes related to ethics, chemical waste handling, and broader societal issues related to chemistry.
3. Each student will present a seminar on a subject related to chemistry in the senior year. The student will gather and organize the necessary information, develop appropriate visual media, and write an abstract of the talk. Faculty will evaluate the written and oral presentations.

- Bachelor of Science with a Major in Chemistry (http://catalog.valdosta.edu/archive/2023-2024/undergraduate/academic-programs/sciences-mathematics/chemistry-geoscience/bs-chemistry/)
- Bachelor of Science with a Major in Environmental Geosciences (http://catalog.valdosta.edu/archive/2023-2024/undergraduate/academic-programs/sciences-mathematics/chemistry-geoscience/bs-environmental-geosciences/)
- Minor in Chemistry (http://catalog.valdosta.edu/archive/2023-2024/undergraduate/academic-programs/sciences-mathematics/chemistry-geoscience/minor-chemistry/)
- Minor in Geography (http://catalog.valdosta.edu/archive/2023-2024/undergraduate/academic-programs/sciences-mathematics/chemistry-geoscience/minor-geography/)

- Minor in Geology (http://catalog.valdosta.edu/archive/2023-2024/undergraduate/academic-programs/sciences-mathematics/chemistry-geoscience/minor-geology/)

Chemistry

CHEM 1010. Introductory Chemistry for Environmental Studies. 4 Hours.
A chemistry course with a focus on real-world societal issues. Students will develop critical thinking skills and an appreciation for the theoretical and practical aspects of chemistry while learning the fundamentals of chemistry. Chemical knowledge will be developed on a need-to-know basis in decision making activities. The course is designed for non-science majors seeking a laboratory science course.

CHEM 1110K. Introduction to General, Organic, and Biological Chemistry. 4 Hours.
An introduction to the fundamental principles of chemistry, emphasizing modern atomic theory, the structure and behavior of atoms, the properties and states of matter, energy relations, periodicity, mole concepts, and the preparation and reactions of organic compounds in light of modern theories of molecular structure. Study will also include the chemistry of living systems, structure of biological molecules, metabolism, and molecular genetics. Laboratory experiments supplement the study of the listed topics.

CHEM 1151K. Survey of Chemistry I. 4 Hours.
A study of the fundamental principles of chemistry emphasizing modern atomic theory, the structure and behavior of atoms, the properties and states of matter, energy relations, periodicity and mole concepts. Laboratory experiments supplement the study of the listed topics.

CHEM 1152K. Survey of Chemistry II. 4 Hours.
Prerequisite: CHEM 1151K with a grade of “C” or better. A study of the properties, preparation, and reactions of organic compounds in light of modern theories of molecular structure. An overview of the chemistry of living systems including the structure of biological molecules, metabolism, and molecular genetics. Laboratory experiments supplement the study of the listed topics.

CHEM 1200. Pre General Chemistry. 3 Hours.
A one-semester introductory and preparatory course for CHEM 1211. This course covers basic concepts in general chemistry with concentration on problem solving and a focus on mathematical operations, nomenclature, measurements, classification of matter, and stoichiometry, atomic structure, and other basic principles. This course is for students who want to take CHEM 1211 Principles of Chemistry I but have not taken high school chemistry or the prerequisite for CHEM 1211.

CHEM 1210. First Year Seminar. 1 Hour.
An introduction to the college-level study of chemistry. Topics include an introduction to the chemistry department, the American Chemical Society, program of study and career planning, computer skills, library skills, chemical safety, and resources to support strategies for success at the undergraduate level and beyond.

CHEM 1211. Principles of Chemistry I. 3 Hours.
Prerequisite: SAT mathematics score of 560 or higher, a mathematics ACT score of 23 or higher, VSU Math Placement Level of 3 or higher, a passing score on the Chemistry Department placement exam, or CHEM 1200 with a grade of “C” or higher. Prerequisite or corequisite: MATH 1111, MATH 1112, or MATH 1113. Corequisite: CHEM 1211L. An introduction to a quantitative study of the physical and chemical behavior of matter in its several phases and a consideration of modern theories of bonding forces at the molecular level. Atomic and molecular structure, chemical nomenclature, stoichiometry, thermochemistry, the gaseous state, and properties of solutions are discussed.

CHEM 1211H. Honors Principles of Chemistry I. 3 Hours.
Prerequisite: SAT score of 560 or higher, a mathematics ACT score of 23 or higher, VSU Math Placement Level of 3 or higher, a passing score on the Chemistry Department placement exam, or CHEM 1200 with a grade of “C” or higher. Prerequisite or co-requisite: MATH 1111, MATH 1112, or MATH 1113. Co-requisite: CHEM 1211L High school chemistry is recommended but not required. Fundamental theories of chemistry with additional focus on medical and environmental issues. The course is taught in an enriched environment in which the experimental nature of chemical knowledge is stressed and the development of critical thinking skills is emphasized.

CHEM 1211K. Principles of Chemistry I. 4 Hours.
First course in a two-semester sequence covering the fundamental principles and applications of chemistry designed for science majors. Topics to be covered include composition of matter, stoichiometry, periodic relations, and nomenclature. Laboratory exercises supplement the lecture material. Prerequisites: High school chemistry course with laboratory or introductory college chemistry course with laboratory. College algebra. Precalculus as a prerequisite or co-requisite is highly recommended. For more information on this institution's eCore courses, please see http://www.valdosta.edu/ecore/.

CHEM 1211L. Principles of Chemistry Laboratory I. 1 Hour.
Prerequisites or corequisites: MATH 1111 or MATH 1113, and CHEM 1211. Laboratory exercises to supplement material discussed in CHEM 1211.

CHEM 1212. Principles of Chemistry II. 3 Hours.
Prerequisites: MATH 1111 or MATH 1113, and CHEM 1211 and CHEM 1211L, each with a grade of “C” or better. Corequisite: CHEM 1212L. A continuation of the quantitative study of the physical and chemical behavior of matter in its several phases and a consideration of modern theories of bonding forces at the molecular level. Reaction kinetics, chemical equilibrium, oxidation-reduction and acid-base chemistry, electrochemistry, chemical thermodynamics, nuclear chemistry, and the descriptive chemistry of selected elements and their compounds are discussed.

CHEM 1212K. Principles of Chemistry II. 4 Hours.
Second course in a two-semester sequence covering the fundamental principles and applications of chemistry designed for science majors. Laboratory exercises supplement the lecture material. Prerequisites: CHEM 1211K College algebra. Precalculus as a prerequisite or co-requisite is highly recommended. For more information on this institution's eCore courses, please see http://www.valdosta.edu/ecore/.

CHEM 1212L. Principles of Chemistry Laboratory II. 1 Hour.
Prerequisites: MATH 1111 or MATH 1113, and CHEM 1211 and CHEM 1211L, each with a grade of "C" or better. Corequisite: CHEM 1212. Laboratory exercises to supplement material discussed in CHEM 1212.

CHEM 2210. Sophomore Seminar. 1 Hour.
Discussion of and reports on current topics in chemistry and on topics related to the chemist as a professional. Demonstrated comprehension of topic, knowledge of pertinent literature and competence in communication skills, both oral and written, will be considered in assigning a course grade. Required of majors. One meeting per week.

CHEM 2310. Quantitative Analysis. 4 Hours.
Prerequisite: CHEM 1212/1212L with a grade of "C" or better. A study of techniques of quantitative analysis, involving volumetric, gravimetric, and instrumental methods. Theory underlying the experimental techniques, methods of recording and statistically evaluating data and calculations utilizing the data are considered. The methods discussed are applied in the laboratory to determine certain constituents in several samples.

CHEM 3320. Environmental Chemistry. 3 Hours.
Prerequisite: CHEM 1211/1211L, CHEM 1212/1212L, CHEM 3401, and CHEM 3402. Development of a general understanding of how microscopic properties of atoms and molecules can affect macroscopic changes in the environment. Basic chemical concepts, including equilibrium, oxidation-reduction, kinetics, solubility, acid-base chemistry, and thermodynamics, will be applied to complex environmental processes with heavy emphasis on current environmental problems and concerns. Field trips will be required of all students.

CHEM 3401. Organic Chemistry I. 4 Hours.
Prerequisite: CHEM 1212/1212L with a grade of "C" or better. A study of the structure, properties, preparation and reactions of organic compounds in light of modern theories of molecular structure and reaction mechanisms.

CHEM 3402. Organic Chemistry II. 4 Hours.
Prerequisite: CHEM 3401 with a grade of "C" or better. Continuation of CHEM 3401 with emphasis on spectroscopy, organic synthesis, and reaction mechanisms.

CHEM 3510. Inorganic Chemistry. 4 Hours.
Prerequisites: CHEM 1211, CHEM 1211L, CHEM 1212, CHEM 1212L, each with a grade of "C" or better. Descriptive chemistry of the inorganic elements through discussions of periodic trends, reactivity patterns, and structure. Bonding models, thermodynamics, and acid-base chemistry as they apply to the descriptive chemistry of the elements will be covered.

CHEM 3601. Biochemistry I. 3 Hours.
Prerequisites: CHEM 3401 and CHEM 3402 with a grade of "C" or better and an introductory biology course. Principles of the structure and function of biological molecules including carbohydrates, lipids, proteins, membranes, enzymes and nucleic acids. An overview of the major metabolic and biosynthetic pathways is also presented.

CHEM 3601L. Laboratory Techniques in Biochemistry. 2 Hours.
Corequisite or Prerequisite: CHEM 3601. Experiments to illustrate the principles and research techniques in biochemistry and molecular biology.

CHEM 3602. Biochemistry II. 3 Hours.
Prerequisite: CHEM 3601 with a grade of "C" or better. A continuation of CHEM 3601. Comprehensive discussion of regulatory, metabolic and biosynthetic pathways, advanced enzyme kinetics, regulation of gene expression and recombinant DNA technology.

CHEM 3801. Physical Chemistry I. 4 Hours.
Prerequisites: CHEM 3401, MATH 2262, and PHYS 2211K or PHYS 1111K, all with a grade of "C" or better. Pre or Co-requisites: PHYS 1112K or PHYS 2212K. A theoretical and mathematical treatment of the fundamental theories and laws of chemistry with an emphasis on thermodynamics. Experimental investigations will supplement the study of phase diagrams, solution calorimetry, bomb calorimetry, thermodynamic modeling and additional solid, liquid, and gas phase energy transfer studies.

CHEM 3802. Physical Chemistry II. 4 Hours.
Prerequisites: CHEM 3401, MATH 2262, and PHYS 2211K or PHYS 1111K, all with a grade of "C" or better. Pre- or Co-requisites: PHYS 1112K or PHYS 2212K. A theoretical and mathematical treatment of the fundamental theories and laws of chemistry with an emphasis on quantum mechanics, spectroscopy, and statistical mechanics. Experimental investigations will supplement the study of quantum mechanics, spectroscopy, and statistical mechanics as applied to systems of interest to chemists.

CHEM 4210. Seminar. 1 Hour.
Prerequisites: Senior standing and completion of at least 15 hours of upper division chemistry courses. Discussion of and reports on current topics in chemistry. Demonstrated comprehension of topic, knowledge of pertinent literature, and competence in communication skills, both oral and written, will be considered in assigning a course grade. Required of majors during the senior year. One meeting per week.

CHEM 4310. Instrumental Analysis. 4 Hours.
Prerequisites: CHEM 3401. A study of the advantages and the limitations of the use of instruments for the solution of problems in chemical analysis. The physical and chemical processes, instrumentation, and data analysis techniques as applied to mass spectrometry, optical spectroscopy, nuclear magnetic resonance spectroscopy, separations science, electrochemistry, radiochemical analysis, surface analysis, and thermal analysis will be discussed in lecture and utilized in laboratory.

CHEM 4420. Physical Organic Chemistry. 3 Hours.
Prerequisites: CHEM 3402 and CHEM 3802. A study of the methods used to elucidate organic reaction mechanisms. Topics covered include: reaction kinetics, isotope effects; linear free energy relationships; general acid and base catalysis and the acidity functions; reactive intermediates including free radicals, carbenes, carbanions, and carbocations; symmetry controlled reactions; photochemistry.

CHEM 4510. Advanced Inorganic Chemistry. 3 Hours.
Prerequisites: CHEM 3801 or CHEM 3802 with a grade of “C” or better or permission of the instructor. An advanced course concentrating on specific aspects of inorganic chemistry including discussions of atomic and molecular structure, chemical bonding, isomerism, coordination compounds and descriptive chemistry of selected elements.

CHEM 4510L. Advanced Inorganic Chemistry Laboratory. 1 Hour.
Pre of Co-requisite: CHEM 4510. An advanced course concentrating on synthetic methods in inorganic chemistry. Students will learn techniques to synthesize air-sensitive (main group and organometallic) compounds, inorganic polymers, ceramics, and coordination complexes.

CHEM 4520. Organometallic Chemistry. 3 Hours.
Prerequisites: CHEM 3510 and CHEM 3802, each with a grade of "C" or better. An advanced course concentrating on specific aspects of organometallic chemistry including discussions of chemical bonding, isomerism, reaction mechanisms, and catalysis.

CHEM 4610. Photochemistry and Photobiology. 3 Hours.
Prerequisite: CHEM 3601 with a grade of "C" or better or permission of the instructor. Review of photochemical reaction principles and study of basic mechanisms in photochemistry and photophysics of pigment molecules with emphasis on photobiological processes.

CHEM 4730. Medicinal Chemistry. 3 Hours.
Prerequisites: CHEM 3401 and BIOL 1107 and 1107L, both with a grade of "C" or better or permission of the instructor. Examination of the structure and function of pharmaceutical agents that have achieved FDA approval or are in the research and development pipeline.

CHEM 4800. Internship in Chemistry. 3-6 Hours.
Prerequisites: Junior of Senior standing, minimum 2.5 GPA, permission of Department Internship Coordinator and Department Head. Graded "Satisfactorily" or "Unsatisfactorily". A supervised, practical experience using chemical skills in an appropriate organization. The course provides students with an opportunity to apply skills learned during pursuit of the chemistry degree to real world situations.

CHEM 4810. Computational Chemistry. 2 Hours.
Prerequisite: CHEM 3802 with a grade of “C” or better. Computational and modeling software will be introduced through projects involving systems in physical chemistry and spectroscopy as well as organic chemistry, inorganic chemistry, and biochemistry. Computational predictions will be correlated with laboratory experimental results, either from literature sources or from laboratory work done by the student.

CHEM 4910. Laboratory Problems. 0-3 Hours.
Prerequisite: Consent of the instructor and approval of the Department Head. Experimental work in analytical, inorganic, organic, physical or biochemistry. The student should have completed at least one semester of a background course in the appropriate area in order for the research to be of an advanced nature at the undergraduate level. Although it is not possible to predict the exact time required for a research project, a student should expect to spend at least four hours per week for each credit hour awarded in this course. A report, in a format suitable for presentation to a chemical journal, shall be presented before credit is awarded.

CHEM 4920. Special Topics. 1-3 Hours.
Prerequisite: Consent of the instructor and approval of the Department Head. Topics and credit to be assigned. May be taken more than once if topics are different.

CHEM 4920L. Special Topics Laboratory. 1-2 Hours.
Laboratory topics and credit to be assigned. May be taken more than once if topics are different.

Georgraphy

GEOG 1100. Introduction to Geography. 3 Hours.
A broad introduction to the field of geography, with its various traditions, subfields, and associated technologies. Topic areas covered include the multiple aspects of cultural and physical geography and tools used in the discipline, such as Geographic Information Systems (GIS) and Global Positioning Systems (GPS).

GEOG 1101. Introduction to Human Geography. 3 Hours.
A survey of global patterns of resources, population, culture and economic systems. Emphasis is placed upon the factors contributing to these patterns and the distinctions between the technologically advanced and less advanced regions of the world.

GEOG 1102. World Regional Geography. 3 Hours.
Examination of the interaction among the developed and developing regions of the world. Particular emphasis is placed on the interrelationships of historical, cultural, economic and political elements in critical areas of the world.

GEOG 1103. Geographic Perspectives on Multiculturalism in the U.S.. 3 Hours.
Geographic factors underlying multiculturalism and ethnic relationships in the U.S. Three interrelated themes are emphasized: the spatial development and organization of culture; population growth, migration, and urbanization; and the spatial dimensions of political, economic, and social processes.

GEOG 1105. Health Geography and Pandemics. 3 Hours.
An introduction to human-environment interactions and the influence these interactions have on public health and pandemics. The focus of this course will be on geographical patterns of health and pandemics from the viewpoint of populations rather than individuals.

GEOG 1110. Our Hazardous Environment. 3 Hours.
Also offered as GEOL 1110. A detailed examination of physical environmental hazards that influence human health and habitation. Lectures focus on the causes, processes, and results of naturally occurring and human-induced geologic, hydrologic, and atmospheric events, such as earthquakes, mudflows, floods, hurricanes, soil erosion, and nuclear and toxic waste. Some mathematics is used.

GEOG 1112K. Introduction to Weather and Climate. 4 Hours.
Pre- or corequisite: MATH 1101 or higher. Weather components, processes, and their measurements. Climatic elements and their control factors and geographic classification of climatic and vegetation types are also discussed.

GEOG 1113K. Introduction to Land Forms. 4 Hours.
Prerequisite or corequisite: MATH 1101 or higher. Introductory analysis and classification of major types of land surfaces, stressing geographic characteristics. Study and interpretation of relationships between landforms and other phenomena through maps, aerial photos, and field observations. World coverage with emphasis on North America.

GEOG 1120. Introductory Oceanography. 3 Hours.
An introductory examination of the physical, chemical, biological, and geological characteristics of the Earth's oceans. Effects of human activity on marine environments and resources as well as management of coastal resources will be discussed. Development of geographic skills and map interpretation through charts, graphs, and ocean models will be included.

GEOG 1125. Resources, Society, and Environment. 3 Hours.
Interactions between physical systems and human activities and their effects on environmental quality and stability. Topics include geography of population and resource consumption, food production, water and air quality, energy policy, land/biotic resource management. Contrasting social, ethical, and technological perspectives on environmental concerns are explored.

GEOG 2010. Tools of Environmental Geoscience. 3 Hours.
Also offered as GEOL 2010. An introduction to research techniques for the incoming environmental geoscience majors. This course includes an overview of the discipline and the tools used in geoscience research. Topics may include laboratory safety, research methods, exploration of resources (library and Internet), methods of data collection, data analysis, and scientific reporting of results.

GEOG 2011. Introduction to Geographic Information Science. 3 Hours.
Prerequisite: GEOG 2010 or permission of instructor. Introduction to principles and applications of Geographic Information Science (GIS). This course will examine spatial data acquisition, management, retrieval, analysis, and output. Instruction will involve computer examples and exercises that emphasize real-world problem solving.

GEOG 3020. Global Climate Change. 3 Hours.
Also offered as GEOL 3020. Prerequisites: GEOG 1112K and either GEOG 1113K or GEOL 1121K. An overview of global climate change based on changes to the Earth's atmosphere, lithosphere, and hydrosphere. This course provides an analysis of past climates in the geologic, biologic, and hydrologic record, the impact of fossil fuel utilization on climate over the last 250 years, and links to ice sheets and oceans. The course examines implications of global climate change on the human population, including diseases and severe weather, as well as biogeography, including the extinction of threatened species.

GEOG 3050. Computer Cartography and Image Analysis. 3 Hours.
Prerequisite or corequisite: GEOG 2010 or GEOL 2010. An introduction to digital production of general and thematic maps. Lectures and laboratory exercises cover principles of cartography and remote sensing as well as the manipulation and visualization of spatial data and imagery.

GEOG 3051. Introduction to Geographic Information Systems. 3 Hours.
Prerequisite: Junior standing or permission of the instructor. An examination of geographic information systems, including methods of capture, storage, analysis, and display of spatially-referenced data. Laboratory exercises provide experience with typical GIS operations and applications.

GEOG 3052. Advanced Geographic Information Systems. 3 Hours.
Prerequisite: GEOG 2011 or 3051. Advanced applications of GIS including: overlay analysis, writing short macros for repetitive operations, spatial modeling and technical support of complex land use and natural resource management decision making. Laboratory exercises designed to form a cartographic and software portfolio for students.

GEOG 3053. Application Issues in Geographic Information Systems. 3 Hours.
Prerequisite: GEOG 3051. Operational and planning issues in GIS. Students will learn which issues need to be considered when proposing and implementing software/hardware GIS and will have opportunities to evaluate how a GIS can be used to solve specific planning problems.

GEOG 3054. Introduction to GPS. 2 Hours.
Prerequisite: Junior standing or permission of the instructor. An introduction to global positioning systems (GPS) including reference systems, mapping, positioning methods, sources of error, data collection methodologies, and field procedures. Hands-on exercises will provide experience with typical GPS operation and application.

GEOG 3100. Regional Planning and Environmental Management. 3 Hours.
Prerequisite: Consent of instructor. Introduction to planning for economic development, service provision and resource management at scales larger than municipalities with an emphasis on the environmental impacts of planning policy and regulation.

GEOG 3120. Geosciences Field Trip. 3 Hours.
Also offered as GEOL 3120. Prerequisite: GEOG 1113K or GEOL 1121K. A study of the geology and geography of a selected region during the first week, followed by a two-week field trip to points of interest. The interactions among geology, surficial processes, and organisms and how those interactions impact humans will be emphasized. Field trip destination is different each summer. Student fee required. Offered only during Summer Session I.

GEOG 3150. Meteorology and Climatology. 3 Hours.
Prerequisites: GEOG 1112K. A detailed examination of atmospheric motions and climatic controls including, the Earth's radiation and energy balance, air mass dynamics, weather systems, and past and present climates of the Earth.

GEOG 3200. History of Life. 3 Hours.
Also listed as GEOL 3200. Prerequisites: Sophomore standing and consent of instructor. Principles of paleontology with emphasis on the history of life including vertebrates. Includes an account of the outstanding forms of life from the beginning of earthtime to the present, and those paleontologically significant groups that are uncommon, different, or extinct today.

GEOG 3210. Introduction to Hydrology. 4 Hours.
Also listed as GEOL 3210. Prerequisites: GEOL 1121K or GEOG 1112K, and GEOG 1113K. An introduction to surface and sub-surface hydrology, examining components of the hydrologic cycle. Topics include local and global water balance, precipitation, interception and infiltration, runoff, stream flow, water storage, and groundwater. This course makes use of some mathematical equations.

GEOG 3240. Hydrogeology. 4 Hours.
Also listed as GEOL 3240. Prerequisites: GEOL 1121K or GEOG 1112K, and GEOG 1113K. Introduction to the hydrology of groundwater. Study of the subsurface part of the hydrologic cycle and description of the occurrence, movement, and management of groundwater as a renewable resource. Special emphasis on surface water-groundwater interactions, sensitivity of karst aquifers to environmental stresses, water quality, groundwater contaminations, and field methods that are applied in groundwater studies. Weekend field trip(s) required.

GEOG 3300. Process Geomorphology. 4 Hours.
Also listed as GEOL 3300. Prerequisite: GEOL 1121K, or GEOG 1112K and GEOG 1113K. An introduction to process geomorphology examining landforms and their formative processes. Topics include weathering and slope, fluvial, coastal, aeolian, glacial, and periglacial processes, and the application of soils to geomorphology. This course makes use of some mathematical equations. Field trip required.

GEOG 3310. Physiography of North America. 3 Hours.
Prerequisites: GEOL 1121K, or GEOG 1112K and GEOG 1113K, or consent of the instructor. The physiographic description, including the landforms, soils, structural framework, climate, plant and animal geography, natural resources, and the unique environmental problems of each major physiographic province of the United States and Canada, including Alaska, Hawaii, and Puerto Rico.

GEOG 3320. Geomorphology of Fluvial and Coastal Environments. 3 Hours.
Also listed as GEOL 3320. Prerequisite: GEOG 3300. An examination of processes and landforms in fluvial (river) and coastal environments. Fluvial topics include channel geometry and pattern, characteristics of flow, sediment load, bedforms, and floodplains. Coastal topics include the study of waves and tides, coastal sediment transport, beaches, and the effects of changing sea level. This course makes use of some mathematical equations.

GEOG 3330. Geology, Hydrogeology, and Environmental Issues in Georgia. 3 Hours.
Also listed as GEOL 3330. Prerequisite: GEOL 1121K. An overview of the geologic framework of Georgia and surrounding states, with emphasis on topical hydrogeologic and environmental issues that impact Georgia’s environment. Students receive the appropriate geologic background necessary for careers that address environmental issues in the southeastern United States. One or more field trips to locations in the area will be included.

GEOG 3410. Cultural Geography. 3 Hours.
Prerequisite: consent of the instructor. A study of the Earth as the home of humankind, emphasizing the spatial and functional complexes of human geography. Topics to be considered are population, settlement form, settling processes, resources, and economic, political, and societal organizations.

GEOG 3510. Urban Community Planning. 3 Hours.
Principles and applications of planning for neighborhoods, towns and cities with an emphasis on the United States. Topics covered include: public services, landuse decision making, economic development, growth management and the role of nongovernment organizations.

GEOG 3610. Economic Geography. 3 Hours.
Prerequisites: GEOG 1102K or GEOG 1112K, and GEOG 1113K, or consent of the instructor. A study of areal variations in human economic activities as related to production, exchange, and consumption of economic goods and services. Emphasis is placed on location of economic activities and related theories.

GEOG 3710. Environmental Soil Science. 4 Hours.
Also offered as GEOL 3710. Prerequisites: CHEM 1211 and CHEM 1211L; GEOG 1113K or GEOL 1121K. Soil properties, distribution and classification, factors of soil formation, and the relationships among soils, geomorphology, and the environment, stressing analysis and use of soils and soil databases for proper urban, agricultural, and environmental land use.

GEOG 3810. Introduction to Biogeography. 3 Hours.
Also offered as BIOL 3810. Prerequisites: Three of the following courses: GEOG 1112, GEOG 1113, BIOL 2010, BIOL 2230, or BIOL 2270. An overview of factors controlling the distribution of plants and animals on the Earth. Topics discussed include ecological and evolutionary processes, geophysical and climatic phenomena, and historical and anthropogenic events that have influenced current distributions.

GEOG 3910. European Geography. 3 Hours.
A survey of European geography, with a special emphasis on the European Union. Topic areas covered include physical, economic, political, and cultural geography of Europe.

GEOG 3920. Geography of the Middle East. 3 Hours.
A survey of the nations of the Middle East, with a special emphasis on the Arab-Israeli conflict. Topic areas covered include physical, economic, political, and cultural geography of the Middle East.

GEOG 4700. Field Methods in Environmental Geography. 4 Hours.
Prerequisites: Junior standing and consent of instructor. Study of field techniques and field problems in physical geography. Course includes classroom presentations, field projects, field trips, and writing technical reports.

GEOG 4710. Statistics for Geoscientists. 3 Hours.
Prerequisite: MATH 1401 or permission of instructor. A survey of statistical methods used by geoscientists to solve real-world problems. The course will examine the various quantitative methods available to collect, analyze, and interpret geographic data; enable students to read and understand statistical results presented by geoscientists; help students to apply the correct statistical methods for the collection, analysis, and interpretation of their own data.

GEOG 4800. Internship in Environmental Geosciences. 3-6 Hours.
Prerequisite: Consent of instructor and Department Head. Graded “Satisfactory” or “Unsatisfactory.” A supervised, practical experience using environmental geosciences skills in an appropriate organization. The course provides students with an opportunity to apply skills learned during pursuit of the environmental geosciences degree to real world situations.

GEOG 4860. Geosciences Senior Seminar. 1 Hour.
Also offered as GEOL 4860. Prerequisites: Junior or Senior standing and consent of the instructor. Graded "Satisfactory" or "Unsatisfactory". Exploration and selection of which option of experiential learning students will pursue as a senior. Each student will submit a proposal for approval by their supervising faculty member(s).

GEOG 4861. Senior Thesis. 3 Hours.
Also offered as GEOL 4861. Prerequisite: GEOG 4860 or GEOL 4860. Part of a two-course sequence in which a research project is designed by the student and supervising faculty member(s) in an approved area of interest. Students will collect sample data, conduct data analysis,and write a thesis.

GEOG 4862. Thesis Presentation. 2 Hours.
Also offered as GEOL 4862. Prerequisite: GEOG 4861 or GEOL 4861. The third course in a three-semester research project designed by the student and supervising faculty member(s) in an approved area of interest. Students will present their senior thesis project in both oral and poster form to the department or at an approved professional meeting.

GEOG 4900. Special Topics in Geography. 1-6 Hours.
Prerequisite: consent of instructor. Topic to be assigned by instructor; the course may be repeated more than once if the topics are different.

GEOG 4990. Directed Study in Geography. 1-6 Hours.
Prerequisites: at least Junior standing and permission of advisor, instructor, and Department Head. Study in area or subject not normally found in established courses offered by the department; may also allow students to explore in more detail and/or depth an area or subject covered by the department.

Geology

GEOL 1110. Our Hazardous Environment. 3 Hours.
Also offered as GEOG 1110. A detailed examination of physical environmental hazards that influence human health and habitation. Lectures focus on the causes, processes, and results of naturally occurring and human-induced geologic, hydrologic, and atmospheric events, such as earthquakes, mudflows, floods, hurricanes, soil erosion, and nuclear and toxic waste. Some mathematics is used.

GEOL 1121K. Principles of Physical Geology. 4 Hours.
Prerequisite or corequisite: MATH 1101 or higher. An introduction to the physical processes responsible for the formation and ever-continuing modification of our Earth. Topics covered include the structure of the Earth and plate tectonics, volcanoes and earthquakes, formation of minerals and the rock cycle, origin and evolution of the landscape, and groundwater and energy resources.

GEOL 1122K. Principles of Historical Geology. 4 Hours.
Prerequisite or corequisite: MATH 1101 or higher. An introduction to the physical and biological development of the Earth from its cosmic beginning to the present, with emphasis on reconstructing sedimentary environments, tectonic processes, and life forms represented in selected regions of North America. Topics covered include families of rocks, principles and concepts of geologic time, origin and interpretation of sedimentary rocks, evolution, plate tectonics, origin of the solar system, and a survey of Earth history through time.

GEOL 2010. Tools of Environmental Geoscience. 3 Hours.
Also offered as GEOG 2010. An introduction to research techniques for the incoming environmental geoscience majors. This course includes an overview of the discipline and the tools used in geoscience research. Topics may include laboratory safety, research methods, exploration of resources (library and Internet), methods of data collection, data analysis, and scientific reporting of results.

GEOL 3010. Environmental Geology. 3 Hours.
Prerequisites: Two natural science lab courses. The application of basic geologic principles and techniques to problems in land-use planning, resource management, waste disposal, conservation, energy plant siting, under-and-above-ground construction, subsidence, construction in seismic areas, slope-stability, urban development and other problems resulting from human interaction with the geological habitat.

GEOL 3020. Global Climate Change. 3 Hours.
Also offered as GEOG 3020. Prerequisites: GEOG 1112K and either GEOG 1113K or GEOL 1121K. An overview of global climate change based on changes to the Earth's atmosphere, lithosphere, and hydrosphere. This course provides an analysis of past climates in the geologic, biologic, and hydrologic record, the impact of fossil fuel utilization on climate over the last 250 years, and links to ice sheets and oceans. The course examines implications of global climate change on the human population, including diseases and severe weather, as well as biogeography, including the extinction of threatened species.

GEOL 3050. Oceanography. 3 Hours.
Prerequisites: Two natural science lab courses. The physical, chemical, geological, and biological characteristics of the ocean and the interactions between the hydrosphere, lithosphere, atmosphere, and biosphere.

GEOL 3100. Principles of Mineralogy/Petrology. 4 Hours.
Prerequisites: Sophomore standing, GEOL 1121K and GEOL 1122K, and consent of instructor. An introduction to mineral and rock identification, and the study of the genesis, occurrence, and uses of common minerals and rocks. Laboratory consists of identification of common rocks and minerals.

GEOL 3101. Mineralogy. 3 Hours.
Prerequisites: GEOL 1121K and CHEM 1211 and 1211L, or their equivalents, and/or consent of the instructor. The classification, identification, and crystallography of the principal rock-forming minerals, silicate and non-silicate; and the introduction to the use of the petrographic microscope in the study of the crystallography and identification of minerals.

GEOL 3102. Petrology. 3 Hours.
Prerequisite: GEOL 3101 and/or consent of instructor. Genesis, classification, and properties of igneous, metamorphic, and sedimentary rocks. Laboratory includes the use of analytical methods, hand specimens, thin-section study with the petrographic microscope, and the macroscopic and microscopic properties of important rock types.

GEOL 3103. Environmental Mineralogy and Clay Materials. 4 Hours.
Prerequisites: GEOL 1121K and CHEM 1211 and CHEM 1211L. An introduction to basic concepts of crystallography, mineralogy, and clay minerals, stressing environmental uses and applications. Includes mineral systems, analytical techniques, and basic clay surface chemistry. Laboratory exercises focus on practical applications of mineralogy useful to the modern environmental scientist. Weekend field trips required.

GEOL 3104. Optical Mineralogy and Petrography. 2 Hours.
Prerequisite or corequisite: GEOL 3100. A study of the petrographic microscope, principles of optical crystallography, identification of rock-forming minerals in thin section, and description of igneous, sedimentary, and metamorphic rocks in thin section. A field trip may be required.

GEOL 3120. Geosciences Field Trip. 3 Hours.
Also offered as GEOG 3120. Prerequisite: GEOG 1113K or GEOL 1121K. A study of the geology and geography of a selected region during the first week, followed by a two-week field trip to points of interest. The interactions among geology, surficial processes, and organisms and how those interactions impact humans will be emphasized. Field trip destination is different each summer. Student fee required. Offered only during Summer Session I.

GEOL 3200. History of Life. 3 Hours.
Prerequisites: Sophomore standing and consent of instructor. Principles of paleontology with emphasis on the history of life including vertebrates. Includes an account of the outstanding forms of life from the beginning of earthtime to the present, and those paleontologically significant groups that are uncommon, different, or extinct today.

GEOL 3210. Introduction to Hydrology. 4 Hours.
Also listed as GEOG 3210. Prerequisites: GEOL 1121K or GEOG 1112K, and GEOG 1113K. An introduction to surface and sub-surface hydrology, examining components of the hydrologic cycle. Topics include local and global water balance, precipitation, interception and infiltration, runoff, stream flow, water storage, and groundwater. This course makes use of some mathematical equations.

GEOL 3220. Invertebrate Paleontology. 3 Hours.
Prerequisite: GEOL 1122K or BIOL 2270 or permission of instructor. Identification, classification, and natural history of major groups of invertebrates preserved as fossils in the geologic record, with special attention to those forms commonly encountered in the southeastern United States. Emphasis in laboratory will include taxonomic affinities and functional morphology. Saturday (optional) field trips will be scheduled to local areas of interest.

GEOL 3230. Vertebrate Paleontology. 3 Hours.
Prerequisites: GEOL 1121K and GEOL 1122K, or BIOL 2010 and BIOL 2270. Geologic history and evolution of animals with backbones, with coverage of extinct groups such as the Dinosauria.

GEOL 3240. Hydrogeology. 4 Hours.
Also listed as GEOG 3240. Prerequisites: GEOL 1121K or GEOG 1112K, and GEOG 1113K. Introduction to the hydrology of groundwater. Study of the subsurface part of the hydrologic cycle and description of the occurrence, movement, and management of groundwater as a renewable resource. Special emphasis on surface water-groundwater interactions, sensitivity of karst aquifers to environmental stresses, water quality, groundwater contaminations, and field methods that are applied in groundwater studies. Weekend field trip(s) required.

GEOL 3250. Micropaleontology. 3 Hours.
Prerequisite: GEOL 1122K, GEOL 3210, or consent of instructor. The classification, stratigraphic relationships, and methods of study of microfossils with emphasis on the stratigraphically important groups.

GEOL 3300. Process Geomorphology. 4 Hours.
Also listed as GEOG 3300. Prerequisite: GEOL 1121K or GEOG 1112K, and GEOG 1113K. An introduction to process geomorphology examining landforms and their formative processes. Topics include weathering and slope, fluvial, coastal, aeolian, glacial, and periglacial processes, and the application of soils to geomorphology. This course makes use of some mathematical equations. Field trip required.

GEOL 3320. Geomorphology of Fluvial and Coastal Environments. 3 Hours.
Also listed as GEOG 3320. Prerequisite: GEOG 3300. An examination of processes and landforms in fluvial (river) and coastal environments. Fluvial topics include channel geometry and pattern, characteristics of flow, sediment load, bedforms, and floodplains. Coastal topics include the study of waves and tides, coastal sediment transport, beaches, and the effects of changing sea level. This course makes use of some mathematical equations.

GEOL 3330. Geology, Hydrogeology, and Environmental Issues in Georgia. 3 Hours.
Also listed as GEOG 3330. Prerequisite: GEOL 1121K. An overview of the geologic framework of Georgia and surrounding states, with emphasis on topical hydrogeologic and environmental issues that impact Georgia's environment. Students receive the appropriate geologic background necessary for careers that address environmental issues in the southeastern United States. One or more field trips to locations in the area will be included.

GEOL 3400. Planetary Geology. 3 Hours.
Also offered as ASTR 3400. Prerequisites: GEOL 1121K or GEOG 1112K, and GEOG 1113K. Prerequisite or corequisite: PHSC 1100 or PHYS 1111 or PHYS 2211. A study of the geology of the terrestrial planets and solid-surface moons, asteroids, comets, and meteorites. The course will focus on comparative planetary geology, with emphasis on geologic processes on the surface (e. g., volcanism, impact cratering, tectonism, erosion, mass wasting, mineralogy, and petrology), planetary interiors, and data collection methods such as remote sensing and image analysis.

GEOL 3410. Structural Geology. 4 Hours.
Prerequisites: GEOL 1121K and GEOL 1122K; MATH 1112 or equivalent. Structural features of rocks, such as folds, faults, joints, cleavage, and primary structures, including their origin, classification, analyses and economic relationships. A study of tectonic plate motion is included. Laboratory work includes depth and thickness problems, structure sections, and structure contour maps.

GEOL 3450. Field Methods in Geology. 4 Hours.
Prerequisites: Sophomore standing, GEOL 1121 and GEOL 1122K, and consent of instructor. An introduction to the basic tools and techniques used in preparation of topographic and geologic maps, and profiles and cross-sections. Includes uses of plane table, alidade, brunton compass, and aerial photographs.

GEOL 3500. Principles of Geochemistry. 3 Hours.
Prerequisites: GEOL 1121K, CHEM 1211 and CHEM 1211L, and MATH 2261. The application of chemical principles to study of geological and environmental processes. Course emphasis is on understanding processes that influence the chemistry of water, sediment, and soil. Topics include aqueous solutions, thermodynamics, mineral-water equilibria, oxidation-reduction reactions, and radiogenic and stable isotopes. Laboratory component of the course is field-based.

GEOL 3510. Environmental Issues in Economic Geology. 3 Hours.
Prerequisite: GEOL 1121K. An introduction to the concepts and practice of economic geology, with emphasis on the environmental impact of resource exploitation focusing on the resource industries that exist in Georgia and surrounding states. Topics include traditional metals-based economic geology, industrial minerals, and energy-based resources. One or more field trips to locations in the area will be included.

GEOL 3710. Environmental Soil Science. 4 Hours.
Also listed as GEOG 3710. Prerequisites: CHEM 1211 and CHEM 1211L; GEOG 1113K or GEOL 1121K. Soil properties, distribution and classification, factors of soil formation, and the relationships among soils, geomorphology, and the environment, stressing analysis and use of soils and soil databases for proper urban, agricultural, and environmental land use.

GEOL 4110. Principles of Sedimentation and Stratigraphy. 4 Hours.
Prerequisites: GEOL 1121K and GEOL 1122K. Corequisite: GEOL 3410. The interrelationships of sedimentation, stratigraphy, and paleogeography; methods in sediment studies, stratigraphic interpretation, and correlation. Field trips required.

GEOL 4800. Internship in Environmental Geosciences. 3-6 Hours.
Prerequisite: Consent of instructor and Department Head. Graded "Satisfactory" or "Unsatisfactory." A supervised, practical experience using environmental geosciences skills in an appropriate organization. The course provides students with an opportunity to apply skills learned during pursuit of the environmental geosciences degree to real world situations.

GEOL 4860. Geosciences Senior Seminar. 1 Hour.
Also offered as GEOG 4860. Prerequisites: Junior or Senior standing and consent of the instructor. Graded "Satisfactory" or "Unsatisfactory". Exploration and selection of which option of experiential learning students will pursue as a senior. Each student will submit a proposal for approval by their supervising faculty member(s).

GEOL 4861. Senior Thesis. 3 Hours.
Also offered as GEOG 4861. Prerequisite: GEOG 4860 or GEOL 4860. Part of a two-course sequence in which a research project is designed by the student and supervising faculty member(s) in an approved area of interest. Students will collect sample data, conduct data analysis,and write a thesis.

GEOL 4862. Thesis Presentation. 2 Hours.
Also offered as GEOG 4862. Prerequisite: GEOG 4861 or GEOL 4861. The third course in a three-semester research project designed by the student and supervising faculty member(s) in an approved area of interest. Students will present their senior thesis project in both oral and poster form to the department or at an approved professional meeting.

GEOL 4900. Special Topics in Geology. 1-6 Hours.
Prerequisites: GEOL 1121K and GEOL 1122K, or equivalent, and consent of instructor. Topics to be assigned by instructor; may be taken more than once if topics are different; up to a total of 6 credit hours.

GEOL 4950. Directed Studies in Geology. 1-6 Hours.
Prerequisites: GEOL 1121K and GEOL 1122K; Junior standing; and permission of advisor, instructor, and Department Head. Study of subjects not normally found in established courses offered by this department; may also allow students to explore in more detail and/or depth subjects covered by this department, up to a maximum of 6 credit hours.